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(54) Automatic plant watering apparatus

(57) A plant-watering device comprises a water-holding body 7 formed in one piece of a suitable plastics material by blow-moulding. The body forms a filling chamber 10 flanked by reservoir chambers 8,9, water passing from the former to the latter via a delivery port 12 and filling ports 14,15. A watering chamber having a discharging orifice 20 is positioned beneath one of the reservoir chambers to receive water through a bleed orifice 19. During filling, the reservoirs are vented through venting ports 16,17 and a pressure-relieving duct 21 which has its outlet below the water level in the watering chamber. During use, air pressure within the reservoirs is controlled by means of a venting duct 22 which leads from a moisture-sensitive valve comprising a capillary plug 5, the plug blocking an inlet to the duct and being in contact with plant growing medium to prevent the ingress of air when wet.

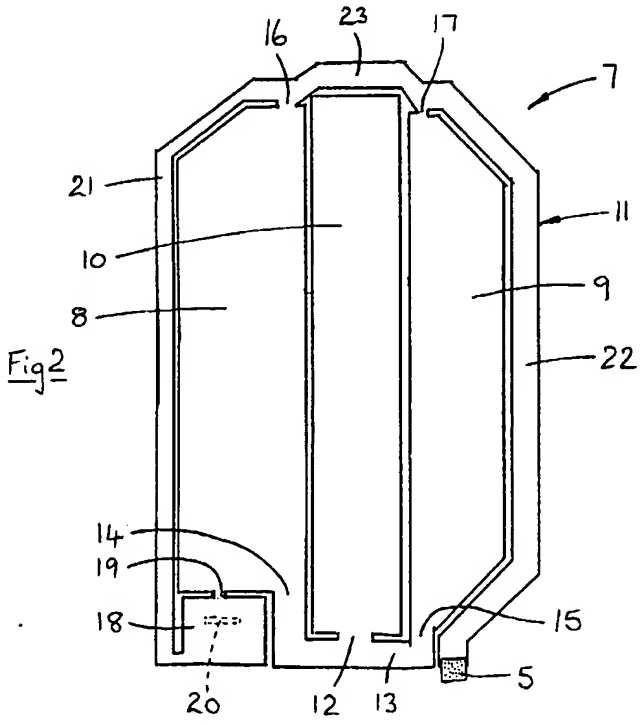

Fig2

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Description

A plant, and particularly but not exclusively a potted plant, needs a regular supply of water for healthy growth. The rate at which water must be supplied is dependent upon a number of factors, including the type and size of plant and environmental conditions. To maintain the plant in a healthy state, watering must be carried out with a frequency and in a quantity to maintain the plant's growing medium correctly moist. A sudden change in environmental conditions can lead to over or under watering. Should watering be forgotten, the growing medium could dry out causing the death of the plant.

There is, therefore, a demand for a device which can be entrusted to water a plant automatically, and various such devices have been proposed. A variety of such devices is described in the prior art, which includes WO 95/10934 and the prior art cited in the Search Report published with that document. In principle, these known devices rely upon a moisture-sensitive air valve (e.g. a porous plug), which is in communication with the growing medium, to admit air to an otherwise-sealed reservoir for controlling the dispensing of water to the medium. Whilst such devices can work well, few if any have reached the market with success, owing not least to the complexity and cost of their construction.

It is an aim of the present invention to provide self watering apparatus of improved construction.

The invention provides, in one of its aspects, automatic watering apparatus for maintaining a plant growing medium suitably moist, the apparatus comprising a water-holding body moulded in one piece and forming:

(i) a filling chamber, a filling opening at a high level in the chamber through which water can be introduced into the chamber, and a delivery port at a low level in the chamber;

(ii) a reservoir chamber, a filling port at a low level of the chamber which is in communication with the delivery port of the filling chamber so that water can pass from the filling chamber into the reservoir chamber, a bleed orifice at a low level in the chamber through which the water can be discharged, and a venting port at a high level in the chamber through which air can be drawn into the chamber under the control of a moisture-sensitive valve of the apparatus; and

(iii) a watering chamber positioned at a low level relative to the reservoir chamber to receive water from the reservoir chamber through the bleed orifice, and a discharging orifice through which water can be discharged from the chamber for delivery to the growing medium.

The body may be of a plastics material and may be formed by injection moulding or blow moulding.

A pressure-relieving duct may connect the reservoir chamber at a high level to the filling chamber or watering chamber at a low level whereby air can be discharged from the reservoir chamber during replenishment from the filling chamber, the outlet of the duct being below water level during normal operation of the device to seal the duct against air being drawing through it into the reservoir chamber.

In a preferred construction the pressure-relieving duct connects the reservoir chamber to the watering chamber. The discharging orifice from the watering chamber is preferably positioned above the bottom of the chamber and the duct arranged to enter the chamber at a level below the orifice in order that it is normally below the water level in the chamber.

A reservoir venting duct may be an integral part of the unitary moulded body, extending to the venting port associated with the reservoir chamber from the moisture-sensitive valve which controls the admission of air to the chamber.

The body may conveniently form two reservoir chambers which are arranged on opposite sides of the filling chamber to receive water from the filling chamber. A continuous duct may extend around the periphery of a compartmented block forming the filling and reservoir chambers, so as to provide both venting and pressure-relieving ducts.

The apparatus compensates automatically for conditions where more or less water must be supplied to the growing medium. For example, it increases the flow when the growing medium is being dried by ambient heat or wind.

Preferably, the flow of water from the discharging port is such as to provide sufficient water to the growing medium without allowing excess water to leave the reservoir. The discharging port may comprise a small hole in a wall of the watering chamber, control of the flow of water through the hole being achieved by control of the air pressure in the reservoir chamber.

There now follows a description, to be read with reference to the accompanying drawings, of an embodiment which illustrates the invention by way of example.

In the accompanying drawings:-

Figure 1 is a view of a plant pot fitted with an automatic watering device; and

Figure 2 is an elevational diagrammatic view of the device itself, shown to a larger scale.

With reference to Figure 1, a plant pot 1 is filled with a growing medium 2, such as a suitable compost, for a plant 3. A watering device 4 is installed inside the pot, against one wall of the pot, the device comprising a capillary plug 5 which is held within the compost in contact with a capillary mat 6 lying on the bottom of the pot; the mat 6 extends towards the centre of the pot from the plug 5.

Turning to Figure 2, the watering device comprises a water-holding body 7 which has been blow-moulded in one piece of a suitable plastics material. The body comprises a generally rectangular flattish block which is compartmented to form two reservoir chambers 8,9 arranged on opposite sides of a central filling chamber 10. A continuous air duct 11 extends around the periphery of the block. The capillary plug 5 is shown inserted into an open end of the duct 11 adjacent to a base of the block, the block being shown in its normal upright orientation.

A filling opening (not shown) at (or adjacent to) the top of the filling chamber 10 permits water to be introduced into the chamber. A delivery port 12 at the bottom of the chamber allows the water to flow from the filling chamber into the two reservoir chambers 8,9 via a distribution duct 13 at the base of the block and filling ports 14,15 into the reservoir chambers. As the water level rises in the reservoir chambers, air escapes into the air duct 11 from the chambers through high level venting ports 16,17 as hereinafter described in more detail.

The moulded body 7 forms also a watering chamber 18 which is positioned at the base of the block adjacent to the distribution duct 13, being located immediately beneath one of the reservoir chambers 8. The watering chamber is so arranged to receive water from the reservoir chamber 8 through a fine bleed orifice 19. At a level well above the bottom of the watering chamber, a discharging orifice 20 allows water to be discharged from the chamber for delivery to the growing medium.

The air duct 11 fulfils two functions. As referred to hereinbefore, an open end of the duct is plugged by means of the capillary plug 5. The other end of the duct leads into the watering chamber 18 at a level below the discharging orifice 20, and so below the normal water level in the chamber. That part of the duct 21 extending from the reservoir venting ports 16,17 to the watering chamber serves as a pressure-relieving duct whereby air can be discharged from the reservoir chambers during replenishment. The outlet end of the duct being below the water level in the watering chamber, that end is sealed against air being drawn through the duct into the reservoir chambers.

Air can be drawn into the reservoir chambers 8,9 through the other part 22 of the air duct, extending as a venting duct between the venting ports 16,17 and the capillary plug 5, under the control of the plug. The plug 5 serves as a moisture-sensitive valve, allowing atmospheric air to be drawn into the reservoir chambers when dry but preventing the passage of air when wet.

It is observed that what have been described as the pressure-relieving and venting parts 21,22 of the duct 11 share use of a linking portion 23 of the duct 11 which is in communication with the reservoir venting ports 16,17.

The device is designed to be placed inside the plant pot 1 with the capillary plug 5 resting on the capillary mat 6 at the bottom of the plant pot and surrounded by the compost 2. Water is poured into the filling chamber 10. As the water passes through the filling ports 14,15 air trapped in the chambers escapes via the pressure-relieving duct 21 into the watering chamber 18; this chamber is vented by means of the discharging orifice 20. Simultaneously, water enters the watering chamber through the bleed orifice 19, to overflow on to the capillary mat 6 once the level in the chamber reaches the discharging orifice.

While the mat 6 in contact with the plug 5 is dry, air will enter the venting duct 22 (via the capillary plug) to replace the water draining from the reservoirs 8,9. However, when the mat 6 becomes saturated, the wet capillary plug 5 effectively seals against ingress of air into the duct. Thus as water continues to flow from the device, pressure in the reservoirs decreases. This has two effects: firstly, water from the mat 6 is pushed upwards within the venting duct by ambient pressure; and secondly flow from the device eventually ceases, its being prevented by ambient pressure once the pressure in the reservoirs 8,9 drops below a threshold level.

From the above it will be appreciated that an initially dry mat 6 is quickly wetted to supply water to the plant 3. Then, equilibrium is reached and flow of water substantially stops.

Further to this, the growing medium 2 will slowly draw water from the mat 6 to replace water consumed by the plant 3 and lost through evaporation. This water will be replaced by the water previously pushed up into the venting duct. The result of this flow of water from the duct is that the pressure within the reservoirs 8,9 is further reduced. Eventually the decrease in the pressure combined with the reduction of the sealing effect due to the reduced head of water in the duct and the reduction of water content of the plug 5, causes the seal to break. Air entering the venting duct rises into the reservoir chambers 8,9 causing an increase in pressure therein. Eventually, the pressure will rise to such an extent that water can once more flow out of the device. The process of wetting of the capillary plug 5 and mat 6 is thus repeated, and continues in cycles.

Claims

1. Automatic watering apparatus for maintaining a plant growing medium (2) suitably moist, the apparatus comprising a water-holding body (7) moulded in one piece and forming:

   (i) a filling chamber (10), a filling opening at a high level in the chamber through which water can be introduced into the chamber, and a delivery port (12) at a low level in the chamber;

   (ii) a reservoir chamber (8), a filling port (14) at a low level of the chamber which is in communication with the delivery port (12) of the filling

chamber (10) so that water can pass from the filling chamber into the reservoir chamber, a bleed orifice (19) at a low level in the reservoir chamber through which the water can be discharged, and a venting port (16) at a high level in the chamber through which air can be drawn into the chamber under the control of a moisture-sensitive valve (5) of the apparatus; and

(iii) a watering chamber (18) positioned at a low level relative to the reservoir chamber (8) to receive water from the reservoir chamber through the bleed orifice (19), and a discharging orifice (20) through which water can be discharged from the chamber for delivery to the growing medium.

2. Apparatus according to claim 1 in which the body is of a plastics material formed by injection moulding or blow moulding.

3. Apparatus according to either of claims 1 and 2 in which a pressure-relieving duct (21) connects the reservoir chamber (8) at a high level to the filling chamber (10) or watering chamber (18) at a low level whereby air can be discharged from the reservoir chamber during replenishment from the filling chamber, the outlet of the duct being below water level during normal operation of the device to seal the duct against air being drawing through it into the reservoir chamber.

4. Apparatus according to claim 3 in which the discharging orifice (20) from the watering chamber (18) is positioned above the bottom of the chamber and the duct (21) arranged to enter the chamber at a level below the orifice in order that it is normally below the water level in the chamber.

5. Apparatus according to any one of claims 1 to 4 in which a reservoir venting duct (22) is an integral part of the unitary moulded body (7), the duct extending to the venting port (16) associated with the reservoir chamber (8) from the moisture-sensitive valve (5) which controls the admission of air to the chamber.

6. Apparatus according to any one of the preceding claims in which the body forms two reservoir chambers (8,9) which are arranged on opposite sides of the filling chamber (10) to receive water from the filling chamber.

7. Apparatus according to any one of the preceding claims in which a continuous duct (11) extends around the periphery of a compartmented block forming the filling (10) and reservoir (8) chambers, the duct being open to the venting port (16) in the reservoir chamber (8) and extending between the moisture-sensitve valve (5) at one end and at its other end an outlet below normal water level in the filling chamber (10) or watering chamber (18).

8. A water-holding body (7) moulded in one piece and suitable for use in automatic watering apparatus for maintaining a plant growing medium suitably moist, the body forming:

(i) a filling chamber (10), a filling opening at a high level in the chamber through which water can be introduced into the chamber, and a delivery port (12) at a low level in the chamber;

(ii) a reservoir chamber (8), a filling port (14) at a low level of the chamber which is in communication with the delivery port (12) of the filling chamber (10) so that water can pass from the filling chamber into the reservoir chamber, a bleed orifice (19) at a low level in the reservoir chamber through which the water can be discharged, and a venting port (16) at a high level in the chamber through which air can be drawn into the chamber under the control of a moisture-sensitive valve (5) of the apparatus; and

(iii) a watering chamber (18) positioned at a low level relative to the reservoir chamber (8) to receive water from the reservoir chamber through the bleed orifice (19), and a discharging orifice (20) through which water can be discharged from the chamber for delivery to the growing medium.

9. A body according to claim 7 which is of a plastics material and formed by injection moulding or blow moulding.

10. A body according to either of claims 8 and 9 comprising a continuous duct (11) which extends around the periphery of a compartmented block forming the filling (10) and reservoir (8) chambers, the duct being open intermediate its ends to the venting port (16) in the reservoir chamber (8) and the duct extending between an opening at one end through which air can be drawn for entry into the reservoir chamber and an outlet at its other end which opens into the filling chamber (10) or watering chamber (18) at a low level.

Fig 1

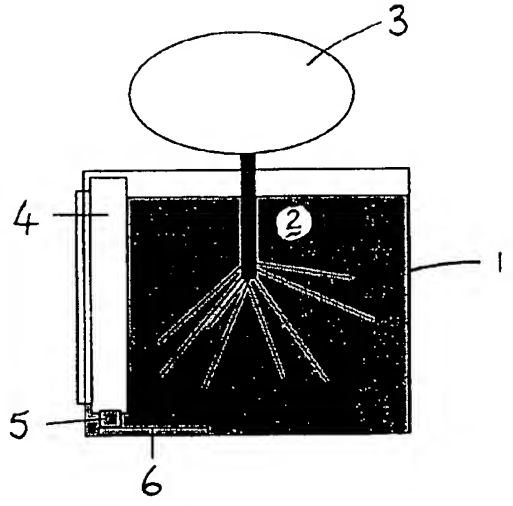

Fig 2